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Incidence and Impact of Damage to Virginia's Timber, 1986

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Foreword

This Bulletin reports survey data on agents damaging trees in Virginia's forests. Data were collected in 1984 and 1985 by the Forest Inventory and Analysis Work Unit of the Southeastern Forest Experiment Station. This effort was part of the fifth inventory of the State's forests. Damage information similar to the previous survey was gathered for this inventory, which makes comparisons over time possible.

The Southeastern Forest Experiment Station in Asheville, NC, periodically inventories and evaluates forest resources in Florida, Georgia, North Carolina, South Carolina, and Virginia. The Region 8, State and Private Forestry, Forest Pest Management Staff Unit, headquartered in Atlanta, GA, provides training and field support and helps evaluate the data on forest insects, diseases, and other damaging agents.

Damage is described here, but appropriate measures for preventing damage are not. Residents of Virginia requiring technical assistance with forestry problems on State and private land should contact:

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Introduction

During the fifth inventory of Virginia's forests in 1984-1985, damage to live trees on sample plots was noted. Where possible, a cause or damaging agent was specified. This Bulletin reports and interprets these observations.

Since plots are visited only once but at any time of the year, it is only possible to keep records on agents that produce symptoms or signs in all seasons. On the basis of these "durable" symptoms and signs, the recognized agents are listed in "Definitions."

Before the field survey, an entomologist and pathologist from Region 8, State and Private Forestry, Forest Pest Management, trained the field crews in the use of a damage-identification handbook, which was used throughout the survey. During the survey, they field-checked data collected by crews to ensure accuracy and consistency. It should be recognized that the data reported here were gathered by people experienced in forest inventory, not entomology and pathology.

Agents selected for the survey were required to be (1) easily identifiable, (2) present year around, and (3) present on trees at least 1 inch in diameter at breast height (d.b.h.). Therefore, small trees with problems such as brownspot and trees of all sizes with damage such as defoliation (which is not apparent in winter) are not accounted for in this report.

There are three reasons why this report cannot accurately assess the incidence and impact of all damage that occurred in Virginia's forests. First, damage is caused by a wide variety of agents, some of which are easily recognized, and others which are more difficult to identify. The data presented here for damaging agents that are easily identified and persistent, such as hardwood cankers, are very reliable. The data for damaging agents that are more difficult to recognize, such as root rot, are underestimated.

Second, certain types of damage can only be observed during part of the year and have not been included in this survey. For example, defoliation caused by insects and diseases is only evident at the time of year the trees are foliated. Since the survey crews work year around, defoliation is one type of damage that cannot be considered. Consequently, we have no information on incidence and impact of defoliation in this report.

Third, some damaging agents cause trees to die rapidly, and dead trees are recorded in a mortality category. For instance, trees attacked by bark beetles in summer tend to die rapidly. If the survey crew found bark beetles, there is a good chance the trees would be dead and tallied as such. The bark beetle "damaged" trees would not show up in a listing of damaged trees.

In spite of these problems, the survey gives a good picture of the relative incidence and impact of damaging agents that are easily recognized and persist year around. This is the context in which the report should be read.

Sampling Procedure

The sampling procedure used for the inventory was designed to provide reliable statistics primarily for the whole State, for large groups of counties, and for species with relatively large total volumes in the State. Accordingly, the errors associated with relatively minor species, like cottonwood, exceed those for major species, such as loblolly pine. Procedures were as follows:

- Initial estimates of forest and nonforest acreages were developed from the classification of 74,655 sample clusters systematically spaced on the latest aerial photographs available. Field crews checked a subsample of 7,006 of these 16-point clusters on the ground. A linear regression was fitted to the data to develop the relationship between

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the photo and ground classification of the subsample. This procedure provided a means for adjusting the initial acreage estimates for change in land use since date of photograph and for photo misclassifications.

• For the entire State, estimates of timber volume and forest classifications were based on measurements recorded at 4,266 ground-sample locations systematically distributed on timberland. The plot design at each location was based on a cluster of 10 points. In most cases, variable plots delineated with a basal area factor of 37.5 square feet per acre were systematically spaced within a single forest condition at 5 of the 10 cluster points. Trees less than 5.0 inches d.b.h. were tallied on fixed-radius plots around the point centers.

• Equations developed from detailed measurements of standing trees in Virginia and throughout the Southeast were used to compute volumes of individual tally trees. A mirror caliper and sectional aluminum poles were used to measure upper stems of standing trees. In addition, felled trees were measured at 105 active cutting operations to provide utilization factors for the different timber products and species groups and to supplement the standing-tree volume study.

• Growth, removals, and mortality were estimated from the remeasurement of 4,150 permanent sample plots established in the fourth inventory. A survey of timber products output, conducted by the Virginia Department of Forestry, along with the annual pulpwood production study in the South, provided additional information for a breakdown of removals, by product.

All field data were sent to Asheville for editing and were entered into disk and magnetic-tape storage for processing. Final estimates were based on statistical summaries of the data. As data collection by each of the five Survey Units in Virginia was completed, special summaries of the information were added to master data files of forest resource statistics maintained in Asheville for the entire Southeast. A Forest Information Retrieval (FIR) program is available for compiling information for any area of interest as a cooperative service.

Computations

1. Limits on size classes of trees were: saplings, 1.0 to 5.0 inches d.b.h.; softwood poles, 5.0 to 9.0 inches d.b.h.; hardwood poles, 5.0 to 11.0 inches d.b.h.; softwood sawtimber, 9.0 inches d.b.h. and above, and hardwood sawtimber, 11.0 inches d.b.h. and above.

2. Volume equations were based on detailed measurements of standing and felled trees in Virginia and similar measurements taken from other trees throughout the Southeast. These were used to compute merchantable and total cubic volume.

3. The symptoms used to identify the cause of damage to living trees on the sampled plots are listed in "Definitions." The percentage of incidence and volume of cull associated with each damage class were determined for each species. Note that these data do not imply total tree loss. Only a part of the volume loss due to cull would fail to qualify for some commercial use, such as firewood. The volume loss was determined by totaling the volume of cull associated with each damaging agent, by species.

4. Quality loss was determined by taking the number of trees that were sufficiently large for sawtimber trees but did not qualify because of damage. The cubic-foot volume in the saw-log portion of these trees was computed. This volume is taken as the quality loss. Note, however, that the quality losses in trees that were not damaged enough to be withdrawn from the sawtimber category are excluded.

5. Mortality could not be attributed to damaging agents because it was often impossible to determine the cause of death. In many cases, a tree tallied

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in the previous survey was simply missing. It was possible, however, to determine volume loss to mortality for each tree species on each plot. By using total mortality by tree species, it was possible to arrive at a total volume loss for poles and sawtimber by tree species.

Incidence of Damaging Agents and Associated Cull

Virginia has 15,435,836 acres of timberland, and most of the acreage is in the oak-hickory, oak-pine, loblolly pine, and Virginia pine forest types (Brown 1986). Table 1 shows the acreage in the various stand-size classes and forest types. The remaining tables in this report show how much of the timber resource is damaged and the agents responsible for the damage. Remember, the term "damage" refers to an injury the tree has suffered. A damaged tree is still alive.

Overall, hardwoods had a higher incidence of damage than softwoods. For most hardwood species, 40 to 70 percent of the saplings were damaged and most of this can be attributed to form damage. Tupelo and blackgum, black walnut, and basswood all had 70 percent or more damaged saplings. The highest incidence of damage to sawtimber-size hardwood trees occurred on cottonwood (67 percent). Table 2 shows percentages of trees damaged, by size class and tree species.

Table 3 shows damage incidence and volume loss due to cull for hardwoods, by tree species. Of all the types of damage found on hardwoods, basal defect had the highest associated volume loss due to cull and quality loss. Basal defect affects the usable volume in the tree because there is usually some type of rot associated with it, and this affects the first and largest log of the tree. Basal defect is usually associated with fire or past logging. The major hardwood species, from an economic point of view, are red oak, white oak, and yellow-poplar. Although the percentage of incidence of basal defect is fairly low for these species, the associated volume loss due to cull is very high. Volume loss in cull is rotten wood and does not provide any economic return. Quality loss, where sawtimber-size trees cannot be used for sawtimber due to defects, is even greater than cull. Trees with quality loss, however, can still be used for pulpwood or firewood, and therefore provide the owner with some economic return.

Cottonwood sawtimber had a high incidence of logging damage (32 percent) and the highest incidence of hardwood borer damage (24 percent) of any hardwood species. Carpenterworm, poplar borer, and cottonwood borer are the likely causes of the borer damage. Although many cottonwoods had borer damage, there was not any related volume loss. On the other hand, select white oak sawtimber had only 2 percent incidence of borers, but an associated quality loss of 1,200,000 cubic feet.

Form damage to saplings is very high for all hardwood species, particularly those growing in bottom lands (bay and magnolia, tupelo and blackgum, soft maple, ash, and elm). Black walnut, basswood, and black cherry also had high incidence of form damage on saplings. Saplings also exhibit damage due to suppression and stagnation, usually between 5 and 10 percent. Hickory had an unusually high incidence of terminal shoot and stem borers; 21 percent of saplings were affected and 12 percent of the poletimber. The twig girdler, Oncideres cingulata, is probably the cause of this damage. The highest incidence of hardwood borers on saplings was observed on soft maple (11 percent).

This survey indicates a fairly high incidence of dieback for all oak species, but particularly the other red oaks group, which contains scarlet, red, and black oak. Mortality is also very high for this species group. These losses can be attributed largely to oak decline. Oak decline is a forest condition characterized by progressive dieback and eventual death of groups of oak trees, especially scarlet, red, and black oak. Dieback begins when healthy trees are

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subjected to some kind of stress, such as drought or defoliation, which weakens them. If trees are repeatedly subjected to stress, they begin to show signs of dieback. Trees in this condition are prime targets for pathogens and insects which weaken the trees further and eventually kill them. Oak decline is very prevalent throughout the Southeast and especially in Virginia.

Black walnut had particularly high damage incidence in all size classes. Although a small component of Virginia's forest, black walnut is a valuable species and therefore of interest. It is an intolerant species and does not grow well in the understory. This probably contributes to the high level of suppression and stagnation that was observed. Black walnut also tends to be a limby tree with poor form, which is accentuated by various insects which bore into the twigs and branches, causing damage. Nectria canker is a disease which attacks black walnut and is most likely responsible for the hardwood canker damage listed.

Table 4 shows damage incidence and volume loss due to cull for softwoods, by species. Loblolly and Virginia pine are the two major softwood species in Virginia. Virginia pine has a higher incidence of damage and more volume loss related to those damages than loblolly pine. This is mainly due to a higher occurrence of poor form, suppression and stagnation, and other unidentifiable diseases on Virginia pine.

Suppression and stagnation and form are the most prevalent damage types in softwood saplings.

The incidence of bark beetle damage on live softwood trees is very low, even though bark beetles are the major insect pests of pine in the Southeast. The main reason that bark beetles do not show up as a significant damaging agent is that this survey reports damage to living trees, and most often bark beetles are associated with dead trees. Therefore, bark beetle-infested trees would be considered damaged only when they were newly attacked and not yet dead. Bark beetle outbreaks also occur in cycles, so it is highly probable that a survey may not coincide with a beetle outbreak. In fact, this survey of Virginia's forests was conducted during a time when bark beetle populations were low.

Reported incidence and associated volume loss due to insect damage on both hardwoods and softwoods were very low. This is because it is difficult to diagnose the occurrence of many types of insect damage, and significant damage from insects usually occurs in cycles. Insect outbreaks are easily missed in a survey done periodically.

In the fourth survey of Virginia, disease damage information similar to that of the fifth survey was gathered, making comparisons between the two surveys possible. Percentage of incidence for diseases and hosts is compared over the two surveys in tables 5 and 6. In hardwoods there was an increase in the incidence of basal defect in all species and age classes. Percentage of incidence of diseases on conifers was essentially the same, except for a decrease in basal defect in cypress poletimber.

Gypsy Moth

In the fifth survey of Virginia, the field crews also made note of gypsy moths on the plots. Various codes were used to indicate the presence of egg masses or larvae on the plot or on-the-way to the plot. Gypsy moth egg masses or larvae were observed on 30 plots, located mainly in the northernmost counties (fig. 1). These plots are located in the "generally infested" area of Virginia, an area where the gypsy moth is considered a resident and eradication is no longer possible. The plots also occur in counties rated as highly susceptible to gypsy moth defoliation in the publication "Risk Rating for the Gypsy Moth in Virginia" (Huber and others 1982). By the time of the sixth survey of Virginia, the gypsy moth will probably have moved south, and

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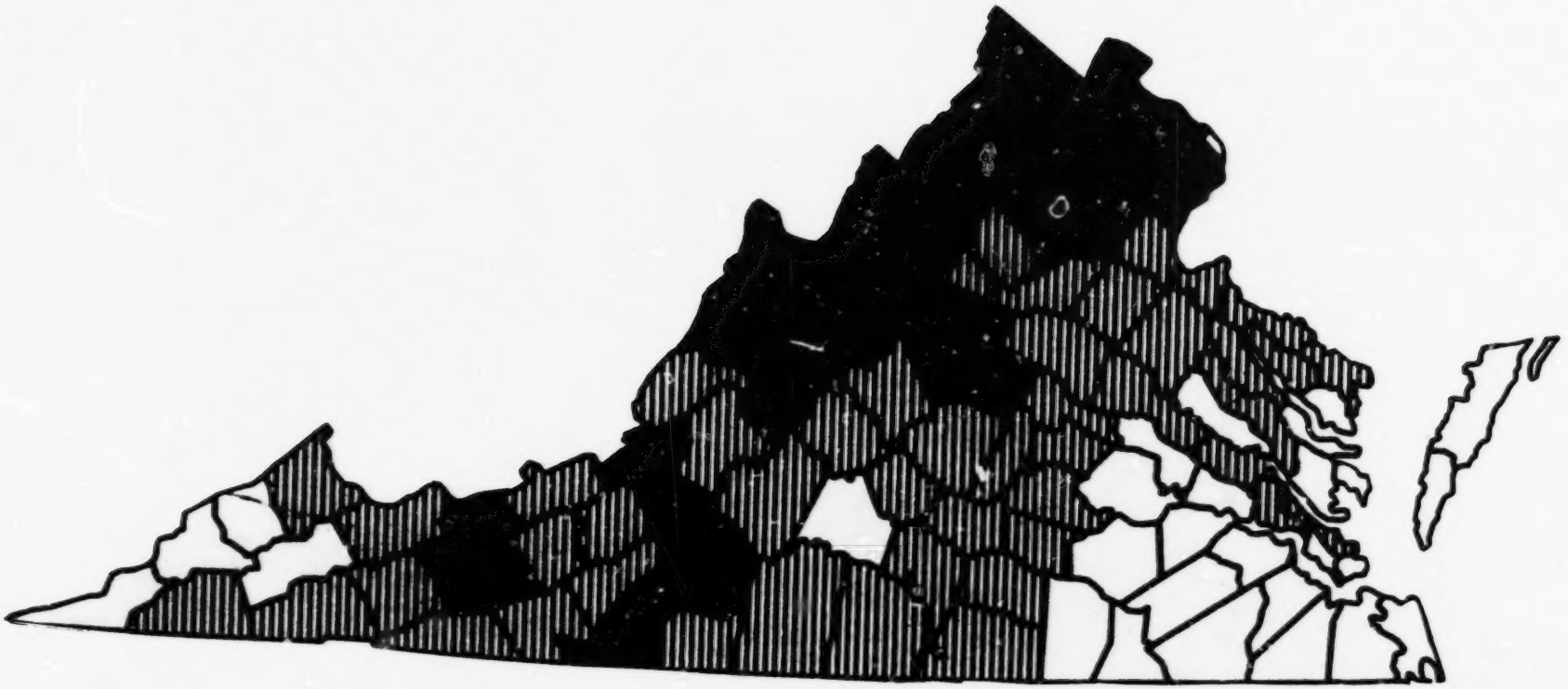

Figure 1.--Gypsy moth activity on Forest Inventory and Analysis sample plots in Virginia, 1985. Each dot represents the presence of gypsy moth egg masses or larvae on one sample plot. Dots indicate the general locations of the plots. This map also shows the level of susceptibility to defoliation by the gypsy moth for each county, based on an earlier publication (Huber and others 1982). White areas indicate 0 to 25 percent of the timberland is susceptible to defoliation or there is no susceptible host type. The striped areas indicate 26 to 50 percent of the timberland is susceptible, and gray areas indicate 51 to 75 percent of the timber is susceptible to gypsy moth defoliation.

we will be able to see if the infestation level correlates with the amount of susceptible forest, by county.

Mortality, Losses to Cull, and Quality Loss

Annual mortality for all live hardwood timber was over 150 million cubic feet; for softwood timber, 77 million cubic feet. Hardwood mortality was 48 percent of the annual harvest and softwood mortality was 37 percent. More than 53 percent of hardwood mortality and 49 percent of softwood mortality occurred in sawtimber-size trees. The mortality figures shown in table 7 are the total for the resource and do not reflect any discounting for trees whose death represented no economic loss. Table 7 also shows the estimated volumes of cull and quality loss for the major species groups in Virginia. Annual harvest figures are given to place the volume losses in perspective.

The volume loss due to cull is much greater in hardwoods than softwoods. The annual accumulated cull for hardwoods is 19 percent of annual hardwood mortality, whereas cull for softwoods is only 1 percent of softwood mortality. Quality loss was also greater in hardwoods than softwoods. It should be noted that mortality figures are on an annual basis, whereas annual accumulated cull and quality loss were determined by dividing total accumulated cull and quality loss by 9.2, so that losses were distributed over the remeasurement period.

Definitions

Damaging Agents and Their Symptoms

Diseases

Fusiform rust.--Slash, loblolly, pitch, pond, and shortleaf pines. Spindle-shaped galls form on the stem or on branches within 12 inches of the bole. Older galls appear as cankers with sunken, rotten centers encircled by a callus ridge. Witches'-broom is common at galls. Bright-orange spores are produced on the galls in the spring.

Hardwood cankers.--All hardwoods. Dead, sunken area on the stem, frequently with annual callus ridges around the dead area.

Littleleaf disease.--Shortleaf and loblolly pines, but shortleaf is more susceptible. Affected trees occur in groups. Short, yellow needles; reduced shoot growth; and large crops of undersize cones are typical symptoms. Littleleaf disease usually occurs in trees growing on heavy soils with poor internal drainage.

Pitch canker.--Most southern pines, but primarily slash, loblolly, and shortleaf. Symptoms are flagging at branch ends, pitch flow from affected area, slight swelling on affected stems and twigs, crooks in main stem, and wilting of current candles.

Root rots.--All species. Diseased trees often with thin, tufted crowns, frequently occur in groups that usually contain dead or windthrown trees. Conks (fruiting bodies) of various fungi may be present on or near the base of diseased trees. Root rots are more frequent in trees of reduced vigor, thinned stands, and in trees with butt or root injury. Trees with root rots are often attacked by bark beetles.

Other diseases.--All species. All damage caused by diseases not identified in separate categories (e.g., red heart of pine, brown spot, and leaf diseases). Trees showing degrade caused by diseases and not identified elsewhere are included in this category.

Growth Defects

Branch stubs.--All species. Branch holes or stubs greater than 4 inches in diameter on stem (trees 5.0 inches d.b.h. and larger). Branch holes or stubs greater than 1 inch in diameter on stem (trees 1.0 to 4.9 inches d.b.h.).

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Basal defect.--All species. Butt swelling, curls, V-shaped stump sprouts, frost seams, and low stubs below d.b.h. are symptoms of basal defect.

Dieback.--All hardwoods. Tips of the branches die back. Initially, only a few branches are affected, but in advanced stages, entire branches die. Tree mortality may result. Dieback is frequently associated with stress caused by an unfavorable environment.

Suppression and stagnation.--All species. Suppressed and stagnated trees are characterized by poor form and small crowns. Suppressed trees are overtopped and receive indirect sunlight. Stagnated trees have thin foliage and receive some direct sunlight. Stagnation is usually associated with poor growing sites or overstocked stands.

Form (damaging).--All species. All trees 5.0 inches d.b.h. and larger that are deformed due to unknown causes.

Natural Phenomena

Fire.--All species. Fire scars are usually at the base of stem and are widespread in the stand. The scars are usually on the uphill side of the tree, and signs of charring are generally present on the stem.

Flooding.--All species. Yellowing and curling downward of leaves, premature leaf fall, branch and top dieback, tree mortality, and high water and silt marks on tree boles are the most common effects of flooding.

Lightning.--All species. Lightning causes bark stripping or cracking, with damage running from the strike point to the ground in a straight line or spirally. Often, the foliage will fade due to root damage or top breakage. Bark beetles often invade struck trees.

Weather.--All species. Windthrow, ice, frost cracks, broken tops, broken branches, marginal leaf burn, and winter burn are the common symptoms.

Animals and Birds

Beaver.--All species. Beavers leave toothmarks and remove the bark from the bole of the tree. Trees are often flooded by water impoundment.

Other animals.--All species. Branches clipped off or broken, bark removed, holes in the stem, and tears and toothmarks in the wood are all common signs of animal activity.

Sapsucker.--All species. Horizontal rows of small holes that may encircle the tree's bole. Bark below the hole is usually streaked or stained by oozing sap.

Insects

Bark beetles.--All pines. Symptoms include pitch tubes, bark beetle galleries on the inner bark surface and the surface of the sapwood, exit holes, and loose bark. Streaks caused by blue stain fungi are often evident on the sapwood. Foliage of infested trees gradually yellows and then turns red.

Hardwood borers.--All hardwoods. The initial symptom is a dark sap spot on the bark surface, often mixed with frass. Eventually, coarse boring particles appear in bark cracks and crevices beneath the point of attack. Old damage appears as knobby overgrowths or scars on the bark surface.

Terminal shoot and stem borers.--All species. Fresh attacks show boring dust and frass at the entrance holes, which are most often located at the base of leaf petioles and buds. Resin globs may be present at points of attack. Dieback results from larval tunneling within terminal shoots and branches. Foliage on the shoots turns yellow, red, and finally brown.

Other insects.--All species. All damage caused by insects not identified in separate categories. Includes hardwood defoliators (e.g., orangestriped oakworm and fall cankerworm), pine defoliators (e.g., redheaded pine sawfly), and pine weevils.

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Human Activities

People.--All species. Initials in bark, nails in tree, lantern burn, bark stripped, wire around stem, and ax marks are signs of damage by people.

Logging and related.--All species. Logging scars on the stem will have callus ridges within 1 to 2 years after wounding. Trees with logging damage are scattered in stands and show no charring. Broken limbs and scars on the stem near the crown will occur from the felling of other trees. Skid trails, stumps, or other evidence of logging will be present.

Turpentining.--Longleaf, slash, and loblolly pines. Damage is seen as exposed wood with V-shaped scars and heavy pitch flow.

Forest Survey and Forest Pest Management Terms

Acceptable tree.--A tree that qualifies as growing stock but does not meet the minimum requirements to qualify as a desirable tree. Included are sawtimber-size trees that do not contain a 12-foot saw log because of excessive, natural taper in the butt log but have the potential to produce a 12-foot saw log as diameter increases.

Basal area.--The area in square feet of the cross section at breast height of a single tree or of all the trees in a stand, usually expressed as square feet of basal area per acre.

Commercial species.--Tree species conventionally regarded as being able to develop into trees suitable for the manufacture of industrial timber products. Species that typically exhibit small size, poor form, or inferior quality are excluded.

Cull loss.--Percentage of trees affected x the percent cull x the volume for the species.

Desirable tree.--A tree that qualifies as growing stock and has no serious defects in quality, limiting present or prospective use; is of relatively high vigor (30 percent or more live crown ratio); is compatible with the site and physiographic class; has a total board-foot loss not to exceed 15 percent in softwoods or 25 percent in hardwoods as a result of severe sweep, crook, or lean; and has a relatively clear bole.

Diameter class.--A classification of trees based on tree d.b.h. (D.b.h. is the common abbreviation for diameter at breast height, 4-1/2 feet above the ground.) Two-inch diameter classes are commonly used by Forest Inventory and Analysis, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h., inclusive.

Growing-stock trees.--Live sawtimber-size trees of commercial species containing at least a 12-foot log, or two noncontiguous saw logs each 8 feet or longer, meeting minimum grade requirements (hardwoods must qualify as a log grade of either 3 or 4; softwoods must qualify as a log grade 3) with at least one-third of the gross board-foot volume (International 1/4-inch rule) between a 1-foot stump and the minimum saw-log top being sound, or a live tree below sawtimber size that will prospectively qualify under the above standards.

Incidence.--Percentage of susceptible trees affected by a damaging agent.

Mortality.--The merchantable volume in trees that have died from natural causes during a specified period.

Noncommercial species.--Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Poletimber-size trees.--Live trees at least 5.0 inches d.b.h. but smaller than sawtimber size.

Quality loss.--Volume in the saw-log portion of trees sufficiently large

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to qualify as sawtimber, but unsatisfactory for sawtimber because of damaging agent.

Rotten trees.--Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of rot or missing sections, and with less than one-third of the gross board-foot tree volume in sound material.

Rough trees.--Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of roughness, poor form, splits, cracks, and with less than one-third of the gross tree volume in sound material; and live trees of noncommercial species.

Saplings.--Live trees 1.0 to 5.0 inches d.b.h.

Saw log.--A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods.

Sawtimber-size trees.--Softwoods 9.0 inches d.b.h. and larger; hardwoods 11.0 inches d.b.h. and larger.

Sawtimber volume.--Growing stock volume in the saw-log portion of sawtimber-size trees in board feet (International 1/4-inch rule).

Species groups.--Sets of tree species pooled together for standard reporting.

Other red oaks: Scarlet, southern red, laurel, water, willow, and black.

Select red oaks: Cherrybark, northern red, and shumard.

Other white oaks: Overcup, post, and live.

Select white oaks: White, swamp chestnut, and chinkapin.

Other eastern hardwoods: Chestnut oak, black locust, yellow birch, buckeye, birch, hackberry, dogwood, persimmon, honeylocust, silverbell, holly, butternut, cucumbertree, mulberry, scrub oaks, willow, and noncommercial species.

Other eastern softwoods: Eastern hemlock, spruce, and fir.

Stand-size class.--A classification of forest land based on the diameter class distribution of growing-stock trees in the stand.

Sawtimber stands: Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands: Stands at least 16.7 percent stocked with growing-stock trees of which half or more of total stocking is in poletimber and sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands: Stands at least 16.7 percent stocked with growing-stock trees of which more than half of total stocking is saplings and seedlings.

Susceptible trees.--All living trees. Includes desirable and acceptable trees, as well as rough and rotten trees.

Timberland.--Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, not currently developed for nonforest use, capable of producing 20 cubic feet of industrial wood per acre per year, and not withdrawn from timber utilization by legislative action.

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Table 1.--Area of timberland, by stand-size class and forest type, Virginia, 1986

Forest classification	Acres
Stand-size class	
Sawtimber	7,329,352
Poletimber	5,102,614
Saplings-seedlings	2,806,064
Nonstocked areas	197,806
All stand sizes	15,435,836
Forest type	
Oak-hickory	9,230,215
Oak-pine	1,689,191
Loblolly pine	1,772,630
Virginia pine	1,029,744
Chestnut oak	454,071
Oak-gum-cypress	310,705
Elm-ash-cottonwood	307,829
White pine-hemlock	183,257
Shortleaf pine	146,573
Eastern redcedar	91,754
Maple-beech-birch	83,408
Pitch pine	68,495
Table Mountain pine	58,258
Pond pine	4,940
Southern scrub oak	4,766
All types	15,435,836

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Table 2.--Percentage of susceptible trees damaged, by species and tree size, Virginia, 1986

Species	Total population (thousands)	Trees damaged		
		Saplings	Poletimber	Sawtimber
		Percent		
HARDWOODS				
Other eastern hardwoods	3,099,070	21	25	35
Soft maple	1,569,142	65	29	39
Sweetgum	770,015	35	20	21
Tupelo & blackgum	681,599	71	30	43
Other red oaks	661,496	34	27	31
Yellow-poplar	600,472	30	22	22
Select white oaks	600,098	39	21	19
Hickory	528,004	62	29	37
Select red oaks	208,049	43	22	29
Beech	174,550	49	19	37
Ash	165,573	63	23	36
Black cherry	133,032	60	33	37
Hard maple	123,897	54	20	39
Elm	95,333	63	36	28
Other white oaks	49,144	40	27	36
Bay & magnolia	45,520	50	19	42
Black walnut	25,094	74	40	40
Basswood	24,573	76	29	34
Sycamore	20,225	46	23	21
Cottonwood	484	0	16	67
SOFTWOODS				
Loblolly pine	775,448	14	7	10
Virginia pine	697,334	29	18	19
Cedars	228,882	30	24	17
Eastern white pine	156,212	27	16	11
Shortleaf pine	112,541	28	15	13
Other eastern softwoods	52,726	18	3	13
Pitch pine	38,268	53	22	17
Table Mountain pine	28,605	42	12	12
Baldcypress	1,024	0	55	10
Pond pine	766	--	21	13

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
SOFT MAPLE (1,569,142,000 susceptible trees)						
Hardwood cankers	2	1	1	92	22	1,470
Root rots	0	0	<1	0	0	0
Other diseases	<1	1	2	229	416	4,553
Branch stubs	<1	1	3	931	3,764	16,839
Basal defects	<1	2	12	2,341	18,028	47,776
Dieback	<1	1	1	295	422	769
Suppression & stagnation	3	2	<1	111	69	376
Form	43	4	7	30	273	1,174
Fire	<1	<1	<1	0	143	1,108
Flooding	0	0	<1	0	134	336
Lightning	0	0	<1	0	76	303
Weather	3	5	5	1,524	1,982	13,527
Beaver	<1	<1	0	0	0	0
Other animals	<1	<1	<1	0	0	515
Sapsucker	0	<1	1	0	0	901
Hardwood borers	11	5	3	102	0	752
Terminal shoot & stem borers	<1	0	0	0	0	0
Other insects	<1	<1	1	0	0	476
People	<1	<1	<1	15	68	1,793
Logging	2	6	2	917	569	4,288
SWEETGUM (770,015,000 susceptible trees)						
Hardwood cankers	<1	<1	1	0	136	509
Root rots	<1	<1	0	0	0	0
Other diseases	<1	<1	<1	25	0	0
Branch stubs	<1	<1	<1	141	361	741
Basal defects	<1	2	5	693	4,890	9,536
Dieback	1	1	2	198	391	1,386
Suppression & stagnation	8	2	<1	10	0	0
Form	20	3	3	0	28	0
Fire	<1	<1	<1	0	87	0
Flooding	<1	<1	<1	62	0	0
Lightning	0	<1	<1	63	31	0
Weather	2	4	4	405	666	759
Beaver	<1	1	<1	0	0	0
Other animals	<1	<1	0	0	0	0
Sapsucker	0	0	<1	0	0	0
Hardwood borers	<1	1	1	22	0	0
Other insects	<1	<1	0	0	0	0
People	<1	<1	2	0	531	383
Logging	3	4	2	333	88	495

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
TUPELO & BLACKGUM (681,599,000 susceptible trees)						
Hardwood cankers	<1	1	1	99	322	1,128
Other diseases	<1	1	2	0	430	1,986
Branch stubs	0	1	3	204	1,504	4,018
Basal defects	<1	4	15	1,292	10,332	24,851
Dieback	1	1	2	92	1,520	2,169
Suppression & stagnation	6	4	1	12	0	0
Form	59	5	10	55	18	0
Fire	<1	0	0	0	0	0
Lightning	0	0	<1	0	15	97
Weather	2	5	4	284	812	2,345
Beaver	<1	<1	<1	0	0	0
Other animals	<1	<1	0	0	0	0
Hardwood borers	1	2	1	0	169	483
People	<1	1	<1	63	30	469
Logging	2	5	3	393	225	1,598
OTHER RED OAKS (661,496,000 susceptible trees)						
Hardwood cankers	1	2	1	97	209	2,785
Root rots	0	0	<1	0	0	0
Other diseases	<1	1	2	10	885	2,008
Branch stubs	0	<1	1	197	1,618	1,140
Basal defects	0	1	4	1,139	13,760	22,534
Dieback	1	6	9	449	895	6,750
Suppression & stagnation	4	2	<1	0	0	0
Form	21	2	2	0	120	833
Fire	<1	1	1	23	562	909
Lightning	0	<1	<1	44	33	1,826
Weather	2	3	5	585	874	2,171
Beaver	0	<1	<1	0	0	0
Other animals	<1	<1	<1	0	24	0
Sapsucker	<1	<1	<1	0	0	0
Hardwood borers	3	5	5	46	82	356
Terminal shoot & stem borers	<1	0	0	0	0	0
Other insects	<1	<1	<1	0	0	0
People	<1	<1	<1	0	205	0
Logging	1	2	1	356	76	362

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
YELLOW-POPLAR (600,472,000 susceptible trees)						
Hardwood cankers	1	1	<1	79	133	1,787
Other diseases	1	1	1	309	336	1,906
Branch stubs	0	<1	<1	57	822	1,125
Basal defects	<1	1	3	707	9,517	14,179
Dieback	<1	<1	<1	0	660	355
Suppression & stagnation	7	2	<1	0	0	0
Form	14	4	3	19	406	610
Fire	<1	<1	1	43	529	1,332
Lightning	0	0	<1	0	497	1,834
Weather	3	6	5	711	1,976	6,174
Beaver	<1	<1	<1	0	0	0
Other animals	<1	<1	<1	0	179	0
Sapsucker	0	<1	2	0	0	0
Hardwood borers	2	3	4	0	333	574
Terminal shoot & stem borers	<1	0	0	0	0	0
Other insects	<1	<1	<1	0	0	0
People	<1	<1	<1	23	423	239
Logging	2	2	1	184	279	1,020
SELECT WHITE OAKS (600,098,000 susceptible trees)						
Hardwood cankers	<1	1	<1	21	98	827
Root rots	0	0	<1	0	0	0
Other diseases	<1	2	1	142	0	0
Branch stubs	0	<1	1	54	1,992	7,142
Basal defects	0	1	4	1,003	12,973	26,692
Dieback	2	4	2	448	268	2,973
Suppression & stagnation	8	2	<1	77	0	0
Form	21	3	3	0	263	1,223
Fire	<1	<1	<1	0	159	0
Flooding	0	<1	0	0	0	0
Lightning	0	<1	<1	15	248	1,402
Weather	2	2	4	312	2,177	7,979
Beaver	0	<1	0	0	0	0
Other animals	0	<1	0	0	0	0
Sapsucker	<1	<1	<1	0	0	0
Hardwood borers	3	4	2	36	0	1,200
Other insects	<1	<1	<1	0	0	0
People	<1	<1	1	44	390	0
Logging	3	2	1	224	167	1,420

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
HICKORY (528,004,000 susceptible trees)						
Hardwood cankers	<1	<1	1	0	213	878
Other diseases	1	<1	<1	0	0	0
Branch stubs	0	<1	<1	78	344	1,514
Basal defects	<1	2	7	756	7,593	14,285
Dieback	1	1	2	0	72	0
Suppression & stagnation	7	1	0	0	0	0
Form	26	2	3	0	33	0
Fire	<1	<1	1	0	22	0
Lightning	0	0	<1	0	0	0
Weather	2	3	4	188	499	2,559
Beaver	0	<1	0	0	0	0
Other animals	<1	0	0	0	0	0
Sapsucker	<1	3	6	0	0	765
Hardwood borers	2	1	2	0	39	0
Terminal shoot & stem borers	21	12	8	0	0	0
Other insects	<1	<1	<1	0	42	0
People	0	<1	<1	64	68	0
Logging	2	3	1	29	102	1,981
SELECT RED OAKS (208,049,000 susceptible trees)						
Hardwood cankers	1	<1	<1	0	239	278
Root rots	0	<1	<1	0	63	630
Other diseases	1	<1	1	0	442	822
Branch stubs	0	<1	1	103	1,669	6,614
Basal defects	0	1	5	150	10,438	22,377
Dieback	1	3	4	0	1,243	3,459
Suppression & stagnation	5	2	<1	0	0	391
Form	25	3	3	0	0	587
Fire	0	<1	<1	0	391	808
Lightning	0	0	<1	0	468	1,486
Weather	2	7	8	315	2,020	6,923
Other animals	0	0	<1	0	0	0
Sapsucker	0	0	<1	0	0	0
Hardwood borers	6	3	4	0	0	0
Other insects	1	<1	1	0	0	0
People	0	<1	1	48	263	0
Logging	1	1	<1	0	241	863

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
BEECH (174,550,000 susceptible trees)						
Hardwood cankers	<1	0	<1	0	0	0
Other diseases	<1	2	1	238	23	0
Branch stubs	0	0	2	0	1,316	3,877
Basal defects	1	3	16	369	16,762	37,979
Dieback	1	0	1	0	181	2,022
Suppression & stagnation	3	1	<1	0	0	475
Form	36	3	6	0	138	0
Fire	0	<1	<1	0	0	0
Lightning	0	<1	<1	112	93	133
Weather	3	3	6	65	578	2,486
Beaver	<1	<1	1	0	0	0
Other animals	0	1	<1	0	0	0
Hardwood borers	1	1	1	0	45	0
Other insects	<1	0	<1	0	0	0
People	<1	<1	1	0	23	468
Logging	2	4	2	163	234	469
ASH (165,573,000 susceptible trees)						
Hardwood cankers	0	<1	1	79	0	0
Root rots	0	0	<1	0	49	164
Other diseases	<1	1	1	0	268	52
Branch stubs	0	1	<1	57	108	919
Basal defects	<1	2	8	474	2,352	5,658
Dieback	<1	2	3	66	114	1,803
Suppression & stagnation	7	2	<1	0	0	444
Form	51	5	13	0	214	0
Fire	0	<1	0	0	0	0
Flooding	<1	0	0	0	0	0
Lightning	0	<1	0	0	0	0
Weather	2	4	6	445	165	2,419
Beaver	<1	1	1	0	41	0
Other animals	0	1	<1	23	37	367
Sapsucker	<1	<1	<1	0	0	0
Hardwood borers	1	1	0	0	0	0
Other insects	0	0	1	0	75	500
People	0	1	0	20	0	0
Logging	1	<1	0	0	0	0

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
BLACK CHERRY (130,032,000 susceptible trees)						
Hardwood cankers	1	2	5	0	37	968
Other diseases	4	7	2	0	0	0
Branch stubs	0	1	2	44	106	859
Basal defects	<1	1	4	145	584	1,955
Dieback	<1	0	2	0	0	676
Suppression & stagnation	3	6	0	0	0	0
Form	48	6	11	0	0	0
Weather	1	6	5	32	118	2,230
Beaver	0	0	2	0	0	0
Other animals	<1	2	0	0	0	0
Hardwood borers	1	1	2	0	0	0
Other insects	0	0	3	0	42	0
People	<1	0	0	0	0	0
Logging	<1	0	0	0	0	0
HARD MAPLE (123,897,000 susceptible trees)						
Hardwood cankers	<1	0	1	0	0	0
Other diseases	0	<1	2	0	67	574
Branch stubs	0	<1	3	42	164	0
Basal defects	0	2	12	295	4,073	11,181
Dieback	0	0	1	0	312	338
Suppression & stagnation	4	0	0	0	0	0
Form	37	3	2	0	0	0
Fire	<1	0	1	0	0	834
Weather	4	6	8	127	570	1,046
Other animals	<1	1	0	0	0	0
Sapsucker	0	2	5	0	0	0
Hardwood borers	5	2	2	0	0	0
People	0	1	0	76	0	0
Logging	2	2	2	315	364	0

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
ELM (95,333,000 susceptible trees)						
Other diseases	<1	1	1	0	0	0
Branch stubs	0	1	2	45	208	610
Basal defects	0	<1	1	19	171	228
Dieback	1	2	<1	35	0	0
Suppression & stagnation	9	8	4	0	0	0
Form	47	8	7	0	83	0
Fire	0	1	0	75	0	0
Flooding	<1	0	0	0	0	0
Weather	1	6	5	344	153	793
Beaver	0	0	1	0	0	547
Sapsucker	0	1	1	0	0	0
Hardwood borers	1	0	2	0	0	0
Terminal shoot & stem borers	<1	0	0	0	0	0
Other insects	0	1	1	0	0	0
People	0	3	2	34	0	0
Logging	3	5	2	89	61	0
OTHER WHITE OAKS (49,144,000 susceptible trees)						
Hardwood cankers	0	2	10	0	52	544
Other diseases	1	2	5	15	38	380
Branch stubs	0	1	1	37	173	351
Basal defects	0	1	7	67	1,235	2,489
Dieback	<1	4	2	36	17	0
Suppression & stagnation	7	1	0	0	0	0
Form	27	2	2	0	0	0
Fire	<1	0	0	0	0	0
Weather	2	2	2	0	0	0
Sapsucker	0	<1	1	0	0	0
Hardwood borers	1	4	1	0	0	0
Other insects	<1	1	0	37	0	0
People	0	2	3	24	51	0
Logging	1	4	2	25	0	635

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
BAY & MAGNOLIA (45,520,000 susceptible trees)						
Other diseases	1	0	0	0	0	0
Branch stubs	0	1	0	20	0	0
Basal defects	0	1	32	39	619	0
Suppression & stagnation	3	0	0	0	0	0
Form	42	5	3	0	0	0
Weather	1	4	7	0	53	0
Other animals	<1	0	0	0	0	0
Sapsucker	0	4	0	0	0	0
Hardwood borers	2	0	0	0	0	0
Logging	2	5	0	25	0	0
BLACK WALNUT (25,094,000 susceptible trees)						
Hardwood cankers	4	7	3	0	121	1,077
Other diseases	0	2	3	16	256	511
Branch stubs	0	0	2	0	342	1,806
Basal defects	1	4	10	56	1,636	6,711
Dieback	0	2	2	0	56	0
Suppression & stagnation	10	8	3	22	0	0
Form	56	2	11	0	31	0
Fire	0	1	0	0	0	0
Weather	0	4	5	170	0	2,854
Hardwood borers	4	3	0	0	0	0
People	0	1	<1	21	30	0
Logging	0	6	1	0	0	0

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
BASSWOOD (24,573,000 susceptible trees)						
Other diseases	2	2	1	0	228	652
Branch stubs	0	0	1	0	356	789
Basal defects	0	1	15	38	3,349	6,320
Dieback	0	0	2	0	137	305
Suppression & stagnation	8	1	0	0	0	0
Form	48	3	5	0	128	0
Weather	9	8	5	60	525	683
Sapsucker	0	1	4	0	0	0
Hardwood borers	6	3	1	0	0	0
Other insects	4	7	1	0	0	0
Logging	0	3	0	0	0	0
SYCAMORE (20,225,000 susceptible trees)						
Other diseases	1	3	0	0	0	0
Branch stubs	0	0	1	0	277	782
Basal defects	0	6	7	207	856	2,837
Dieback	2	4	1	0	62	0
Suppression & stagnation	11	0	0	0	0	0
Form	30	4	2	0	0	0
Flooding	0	0	<1	0	0	589
Lightning	0	2	0	0	0	0
Weather	1	1	4	0	306	1,163
Other animals	0	0	1	0	0	0
Hardwood borers	0	0	1	0	0	0
Other insects	0	0	1	0	0	0
People	0	0	4	0	229	0
Logging	0	3	0	0	0	0

Continued

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Table 3.--Damage incidence and associated cull in hardwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M ft^3$		
COTTONWOOD (484,000 susceptible trees)						
Form	0	0	11	0	0	0
Weather	0	16	0	0	0	0
Hardwood borers	0	0	24	0	0	0
Logging	0	0	32	0	0	0
OTHER EASTERN HARDWOODS (3,099,070,000 susceptible trees)						
Hardwood cankers	<1	1	1	416	370	7,007
Root rots	0	0	<1	0	0	0
Other diseases	1	2	2	1,179	2,321	19,014
Branch stubs	<1	1	1	356	4,165	18,695
Basal defects	<1	3	10	5,243	39,111	122,489
Dieback	<1	3	6	570	2,028	29,072
Suppression & stagnation	4	2	<1	271	28	1,935
Form	7	2	5	37	202	1,112
Fire	<1	<1	<1	190	900	2,861
Lightning	<1	0	<1	0	909	2,591
Weather	3	5	6	2,226	5,165	30,335
Beaver	<1	<1	<1	0	0	0
Other animals	<1	<1	<1	33	0	941
Sapsucker	0	<1	<1	0	0	566
Hardwood borers	2	2	1	217	168	6,776
Terminal shoot & stem borers	<1	0	0	0	0	0
Other insects	<1	<1	<1	96	58	1,176
People	<1	<1	<1	239	78	439
Logging	2	2	1	511	264	3,128

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Table 4.--Damage incidence and associated cull in softwoods in Virginia, 1986

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
LOBLOLLY PINE (775,448,000 susceptible trees)						
Fusiform rust	1	1	1	46	225	0
Littleleaf	0	0	<1	0	0	0
Pitch canker	<1	<1	<1	0	0	0
Root rots	0	<1	<1	0	0	0
Other diseases	<1	<1	<1	0	243	296
Basal defects	0	<1	<1	26	404	251
Dieback	<1	0	<1	0	0	0
Suppression & stagnation	7	1	<1	0	0	0
Form	3	1	1	0	0	0
Fire	<1	<1	<1	18	18	0
Flooding	<1	0	0	0	0	0
Lightning	0	0	<1	0	32	0
Weather	1	2	2	63	72	0
Beaver	<1	<1	0	0	0	0
Other animals	<1	<1	<1	0	0	0
Sapsucker	0	<1	2	0	0	0
Bark beetles	<1	<1	1	0	0	0
Terminal shoot & stem borers	1	<1	0	0	0	0
Other insects	<1	<1	1	0	0	0
People	0	<1	<1	0	210	683
Logging	<1	<1	1	0	26	0
VIRGINIA PINE (697,334,000 susceptible trees)						
Eastern gall rust	1	1	1	0	0	0
Pitch canker	<1	<1	1	0	0	429
Other diseases	4	5	7	23	41	1,189
Basal defects	0	<1	<1	76	463	782
Dieback	<1	<1	0	0	0	0
Suppression & stagnation	11	5	1	0	0	644
Form	10	2	3	0	249	1,228
Fire	<1	<1	<1	0	0	0
Lightning	0	<1	0	0	0	0
Weather	2	2	3	119	440	618
Other animals	<1	0	<1	0	0	0
Sapsucker	0	<1	1	0	0	0
Bark beetles	<1	<1	<1	0	0	0
Other insects	<1	<1	<1	0	0	632
People	<1	<1	<1	0	56	0
Logging	<1	1	1	61	225	0

Continued

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Table 4.--Damage incidence and associated cull in softwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
CEDARS (228,882,000 susceptible trees)						
Other diseases	<1	1	0	0	0	0
Basal defects	0	2	3	53	134	224
Dieback	<1	0	0	0	0	0
Suppression & stagnation	7	5	0	0	0	0
Form	11	1	0	0	0	0
Fire	0	1	0	27	0	0
Lightning	<1	0	0	0	0	0
Weather	6	6	9	146	0	0
Other animals	<1	<1	0	21	0	0
Sapsucker	<1	1	5	0	0	0
Other insects	<1	0	0	0	0	0
People	<1	1	0	14	0	0
Logging	5	6	0	11	0	0
EASTERN WHITE PINE (156,212,000 susceptible trees)						
Blister rust	<1	<1	0	0	0	0
Other diseases	1	<1	<1	0	0	0
Basal defects	1	0	<1	0	988	1,060
Dieback	<1	<1	0	0	0	0
Suppression & stagnation	8	4	2	0	0	0
Form	7	2	2	0	0	0
Fire	0	0	<1	0	0	0
Lightning	0	0	<1	0	0	0
Weather	5	7	5	19	389	822
Other animals	<1	0	<1	0	39	0
Sapsucker	0	0	<1	0	0	0
Bark beetles	<1	0	0	0	0	0
Terminal shoot & stem borers	2	0	0	0	0	0
Other insects	1	1	1	0	147	734
People	0	<1	0	0	0	0
Logging	1	<1	1	0	35	0

Continued

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Table 4.--Damage incidence and associated cull in softwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
SHORTLEAF PINE (112,541,000 susceptible trees)						
Eastern gall rust	0	0	<1	0	0	0
Littleleaf	<1	1	0	0	0	0
Root rots	0	0	<1	0	0	0
Other diseases	1	1	1	0	116	0
Basal defects	0	<1	<1	23	94	0
Dieback	<1	<1	0	0	0	0
Suppression & stagnation	13	6	<1	0	0	0
Form	11	0	2	0	0	0
Fire	0	<1	1	0	0	0
Lightning	0	0	<1	0	0	0
Weather	1	2	2	0	0	639
Beaver	0	0	<1	0	0	0
Other animals	<1	0	0	0	0	0
Sapsucker	<1	<1	1	0	0	0
Bark beetles	0	1	2	0	0	0
Other insects	0	<1	<1	0	0	0
People	0	<1	1	0	149	0
Logging	<1	2	2	30	0	0
OTHER EASTERN SOFTWOODS (52,726,000 susceptible trees)						
Other diseases	0	0	<1	0	156	0
Basal defects	0	0	3	0	736	0
Dieback	1	0	0	0	0	0
Suppression & stagnation	1	0	0	0	0	0
Form	8	2	<1	0	0	0
Weather	4	1	7	0	346	0
Beaver	1	0	0	0	0	0
Sapsucker	0	0	1	0	0	0
Other insects	1	0	0	0	0	0
People	1	0	0	0	0	0
Logging	0	0	2	0	73	97

Continued

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Table 4.--Damage incidence and associated cull in softwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			M ft^3		
PITCH PINE (38,268,000 susceptible trees)						
Other diseases	0	2	3	110	0	0
Basal defects	0	0	1	0	30	602
Dieback	0	0	<1	0	0	0
Suppression & stagnation	11	11	1	0	0	0
Form	28	1	4	0	0	0
Fire	0	1	1	0	0	397
Lightning	0	0	<1	0	75	0
Weather	2	5	2	17	156	519
Sapsucker	0	0	1	0	0	953
Bark beetles	0	0	2	0	0	0
Other insects	7	1	0	0	0	0
People	3	0	<1	0	76	0
Logging	1	0	0	0	0	0
TABLE MOUNTAIN PINE (28,605,000 susceptible trees)						
Dieback	0	1	0	0	0	0
Suppression & stagnation	11	2	0	0	0	0
Form	24	4	7	0	0	0
Fire	0	1	0	0	0	0
Lightning	0	0	<1	0	73	0
Weather	7	1	1	71	0	0
Other animals	0	2	1	0	54	0
Sapsucker	0	1	1	0	0	0
Bark beetles	0	0	1	0	0	0

Continued

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Table 4.--Damage incidence and associated cull in softwoods in Virginia, 1986--Continued

Damaging agent	Incidence of damage			Volume loss due to cull		
	Saplings	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality loss
	Percent			$M\ ft^3$		
BALDCYPRESS (1,024,000 susceptible trees)						
Branch stubs	0	0	2	0	81	0
Basal defects	0	0	3	0	251	201
Dieback	0	0	<1	0	328	546
Form	0	0	<1	0	0	0
Weather	0	34	3	0	0	0
Sapsucker	0	0	1	0	0	0
Other insects	0	21	0	0	0	0
POND PINE (766,000 susceptible trees)						
Other diseases	0	0	4	0	0	0
Suppression & stagnation	0	21	0	0	0	0
Form	0	0	5	0	0	0
Weather	0	0	4	0	0	394

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Table 5.--Comparison of disease incidence in hardwoods for the fourth and fifth surveys in Virginia

Disease and host	Saplings		Poletimber		Sawtimber	
	4th	5th	4th	5th	4th	5th
	Percent					
Hardwood cankers						
Select oaks	0.36	1	0.53	1	0.87	<1
Other oaks	.74	<1	1.97	2	4.23	5
Hickory	.09	<1	.22	<1	1.23	1
Blackgum & tupelo	.26	<1	.49	1	1.19	1
Beech	.72	<1	.85	0	.13	<1
Black walnut	0	<1	9.02	7	7.43	3
Bay & magnolia	0	0	1.04	0	0	0
Basal defect						
Select oaks	2.78	0	1.65	1	3.38	4
Other oaks	2.94	0	3.62	1	3.48	5
Ash	.89	<1	1.55	2	2.99	8
Blackgum & tupelo	3.16	<1	2.46	4	7.54	15
Sweetgum	2.04	<1	1.82	2	2.95	5
Yellow-poplar	.88	<1	1.11	1	1.38	3
Hickory	1.70	<1	1.21	2	2.35	7
Other diseases						
Elm	0	<1	0	1	.33	1
Black walnut	0	0	.62	2	0	3
Basswood	0	2	0	2	.46	1

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Table 6.--Comparison of disease incidence in softwoods for the fourth and fifth surveys in Virginia

Disease and host	Saplings		Poletimber		Sawtimber	
	4th	5th	4th	5th	4th	5th
	Percent					
Fusiform rust						
Loblolly pine	0.85	1	1.4	1	0.92	1
Pitch canker						
Virginia pine	.45	<1	1.24	<1	1.63	1
Shortleaf pine	.28	0	.09	0	.07	0
Root rot						
Loblolly pine	0	0	.02	<1	.05	<1
Littleleaf						
Shortleaf pine	0	<1	.46	1	.16	0
Basal defect						
Cypress	0	0	14.47	0	3.95	3
Cedars	2.28	0	1.05	2	3.97	3
Shortleaf pine	1.14	0	.62	<1	.30	<1
Virginia pine	.42	0	.31	<1	.39	<1
White pine	.87	1	.53	0	.69	<1
Loblolly pine	.18	0	.28	<1	.44	<1
Pitch pine	3.16	0	.77	0	.46	1
Cedars	2.28	0	1.05	2	3.97	3
Table Mountain pine	0	0	1.57	0	.88	0
Pond pine	0	0	0	0	1.72	0
Other diseases						
Loblolly pine	.12	<1	.18	<1	.55	<1
Virginia pine	3.11	4	3.91	5	3.95	7
Shortleaf pine	0	1	.81	1	.74	1
Pitch pine	0	0	.53	2	.43	3
Table Mountain pine	0	0	1.60	0	.74	0
Pond pine	0	0	0	0	3.03	4
Cedars	0	<1	.20	<1	0	0

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Table 7.--Annual volume of timber removals and wood loss due to mortality, cull, and quality loss, Virginia, 1985

Species	Timber removals		Mortality		Cull		
	Poletimber	Sawtimber	Poletimber	Sawtimber	Poletimber	Sawtimber	Quality Loss
	M ft^3						
HARDWOODS							
Yellow-poplar	9,283	39,412	4,570	2,801	232	1,749	3,384
Other red oaks	17,653	37,905	16,367	20,701	320	2,103	4,530
Select white oaks	16,144	37,640	4,186	6,191	258	2,036	5,528
Sweetgum	10,003	16,564	3,156	1,727	212	783	1,501
Select red oaks	2,273	15,981	3,273	7,415	67	1,900	4,917
Soft maple	8,580	13,830	3,866	4,743	716	2,822	10,539
Hickory	5,689	10,828	6,101	7,031	121	981	2,389
Beech	1,235	8,196	377	3,301	103	2,108	5,208
Tupelo & blackgum	2,209	5,297	803	1,028	271	1,671	4,255
Ash	804	3,371	1,670	2,084	127	372	1,340
Sycamore	1,401	1,747	448	585	23	188	584
Elm	1,389	1,404	1,290	1,099	70	73	237
Hard maple	111	1,047	297	400	93	603	1,519
Other white oaks	1,321	807	391	718	26	170	478
Black walnut	582	724	961	1,226	31	269	1,409
Cottonwood	0	329	0	0	0	0	0
Black cherry	1,247	289	691	217	24	96	727
Basswood	0	231	0	410	11	513	951
Bay & magnolia	153	168	308	195	9	73	0
Other eastern hardwoods	11,339	23,476	21,583	18,344	1,259	6,062	26,971
Total	91,416	219,246	70,338	80,216	3,973	24,572	76,467
SOFTWOODS							
Loblolly pine	21,441	87,197	14,536	11,818	17	134	134
Virginia pine	26,422	29,392	16,354	16,378	30	160	600
Shortleaf pine	9,472	21,227	5,119	3,286	6	39	69
Eastern white pine	760	4,565	617	1,297	2	174	284
Pitch pine	500	2,229	1,893	2,693	14	37	269
Baldcypress	108	1,881	0	0	0	72	81
Pond pine	0	916	31	426	0	0	43
Other eastern softwoods	90	677	0	0	0	143	11
Cedars	1,097	558	1,011	437	30	15	24
Table Mountain pine	0	531	227	1,173	8	14	0
Total	59,890	149,173	39,788	37,508	107	788	1,515

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Huber, Cindy M.; McClure, Joe P.; Cost, Noel D.

Incidence and impact of damage to Virginia's timber, 1986. Resour. Bull. SE-90. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1987. 30 pp.

Annual mortality for Virginia's hardwood timber was over 150 million cubic feet; for softwood timber, 77 million cubic feet. Percentage of damage incidence and volume loss to live trees are presented in tables by major timber species and damaging agent.

KEYWORDS: Forest insects, forest diseases.

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